

April 25, 2011
Revised June 27, 2011

RV Drilling Company
505 Salem Street
Paramus, NJ 07652

Re: Geotechnical Engineering Report
FDR Campus, Route 9A
VA Hudson Valley Healthcare Systems
Montrose, NY
Job # 11-056

This report is submitted to **RV Drilling** as per our proposal dated February 22, 2011. It includes our findings, conclusions and recommendations related to the testing of the pavement areas.

The site is located in Montrose, New York. The “Boring Location Plans” Plates 2A through 2G was provided by **DCS Infrastructure, LLC**

INVESTIGATIONS

Twenty one (21) Borings were completed on March 29, 30 & 31, 2011 and April 1, 2011. The Borings were advanced using truck mounted drilling equipment in accordance with the procedures of the Standard Penetration Test (ASTM-1586). For this test, a standard split barrel sampler of two (2) inches outside diameter, one and three eighth (1 3/8) inches inside diameter is advanced into the soil using a one hundred and forty (140) pound weight hammer falling 30 inches. Standard Penetration Tests were taken continuously from zero (0) to ten (10) feet or refusal. The record sheet for each boring is attached to this report.

FINDINGS

Existing Surface Features: The area surrounded with 1 and 2 story building, parking lots and connector roads are located on the property.

Subsurface Conditions: The explorations for this study indicate that the site is underlain by relatively uniform subsurface conditions. The strata are listed below in order of increasing depth. Detailed descriptions of the subsurface conditions are shown on the individual logs of Borings, Plate 3A through 3U.

1. **Asphalt:** A layer of Asphalt was encountered from the surface to depths ranging from one to seven (1-7) inches below the existing surface grade.
2. **Crushed Stone:** A layer of Crushed Stone was encountered in Borings 1, 4, 5, 6, 7, 9, 12, 13, 14, 15, 16, 18, 20 & 21 below the Asphalt to depths ranging from five inches to one foot (5"-1') below the existing surface grade.
3. **Fill:** A layer of Fill was encountered below the Crushed Stone in Borings 1, 4, 5, 6, 7, 14, 15, 16 & 20 and below the Asphalt in Borings 2, 3, 8, 10, 11 & 17 to depths ranging from one to six (1-6) feet below the existing surface grade.
4. **Silty Sand (SM):** A layer of Silty Sand was encountered below the Fill in 2, 3, 5, 7, 8, 10, 11, 15, 16, 17, 19 & 20 and below the Crushed Stone in Borings 9, 12, 13, 18 & 21 to depths ranging from one foot eight inches to ten feet (1'8" – 10') below the existing surface grade.
5. **Clay (CL):** A layer of Clay was encountered below the Fill in Boring 6 to a depth of six (6) feet below the existing surface grade.
6. **Silt (ML):** A layer of Silt was encountered below the Fill in Borings 1 & 4, below the Silty Sand in Boring 3 and below the Clay in Boring 6 to depths ranging from nine feet ten inches to ten feet (9'10"-10') below the existing surface grade.
7. **Silty Sand (SM):** A layer of Silty Sand was encountered below the Silt in Boring 3 to a depth of ten (10) feet below the existing surface grade.
8. **Poorly Graded Sand (SP):** A layer of Poorly Graded Sand was encountered below the Silty Sand in Boring 10 and below the Fill in Boring 14 to depths ranging from two feet eleven inches to ten feet (2'11"-10') below the existing surface grade.

Borings 2, 8, 9, 12, 14, 15, 16, 17, 19, 20 & 21 encountered refusal at 7'10", 3'6", 1'8", 3'7", 2'11", 5'8", 4'2", 3'5", 2'10", 7'10" & 3'5.5" respectively. The refusal depth is defined as the depth where no further penetration can be achieved with earth drilling and sampling procedures. Rock core drilling would be necessary to define whether the refusal depth is cobble, boulders or bedrock.

No ground water was observed in most of the borings, except for Borings 1, 3 & 5 to depths ranging from four feet six inches to six feet eight inches (4'6"-6'8") at the time of the investigation. It should be noted that the water level conditions might vary due to variations in seasons, rainfall, temperature and other factors. Typically, spring time shows the highest water levels in this area and can be considered the seasonal high water table level.

COMMENTS AND CONCLUSIONS

In the areas that the borings were conducted the soil found varied from a very loose to very dense condition across the area. 67% of the Borings showed a layer of Gravel (Crushed Stone) beneath the Asphalt. This layer varied in thickness from one to five (1-5) inches, with the majority of Borings showing around 2 inches. The soft and very soft Silts and Clays found in the Borings are unsuitable material under roadways or parking lot areas. These materials are very susceptible to frost heave when found within the top three to four (3-4) feet from the proposed surface grade. The areas that Fill was encountered below the Asphalt and Gravel could be compacted to a higher density and remain in place.

The existing paving thickness average of three and one half (3.5) inches which is less than the recommended thicknesses for car or truck traffic on parking lots and lightly travelled roads and it is believed that it has surpassed its useful lifespan. The average lifespan of pavement is 20 years with regular maintenance. If an additional 20+ year lifespan of the pavement area is desired we have the following recommendations.

There are few options that can be taken to repair the existing roadways.

- Option 1: Remove only areas with unsuitable substrata, such as Clays and Silts. For this we recommend the removal of all unsuitable material to a minimum depth of two (2) feet below the proposed subgrade elevation and replace with controlled fill in the areas of B – 1, 4, 6, 9, 10 & 21. A sub-base of Quarry Process Stone should be placed with a Stabilized base course and a Surface Course (see recommendation section for additional information). This is especially important in areas that are in lightly travelled roadways. A thicker Surface Course, three (3) inches, might also be warranted in lightly travelled roadways.

- Option 2: Place a Geotextile stabilization fabric, such as Mirafi HP 370, over the existing fill or Silty Sands. The geotextile should NOT be used in areas surrounding Borings 6, 15 & 17, as the subsoils found in these areas are extremely soft.
- Option 3: Do additional borings on the roadways and parking lots where unsuitable material (Silt & Clays) were encountered. This would enable us to define the area to be removed more closely. Distance between the boring should range between 50 and 100 feet increments.
- Option 4: Mill all existing pavement and replace with subbase, base and surface courses. This recommendation is not ideal in the areas where Silt and Clays were found close to the surface. See below for recommendations.

RECOMMENDATIONS

The following geotechnical design and construction recommendations are offered:

1. Parking Lot areas/Roadways:
 - a. Remove an estimated two (2) feet of Fill, soft Silt, Clay down to the medium dense Silty Sand.
 - b. Placement of the Geotextile stabilization fabric instead of removal of unsuitable material, except in areas surrounding Borings 6, 15 & 17. Use a Mirafi HP 370 or equal.
 - c. Proof roll the bottom of the excavated area with a minimum four passes of heavy vibratory compactor with a minimum static drum weight 12,000 pounds or equal.
 - d. Any areas, which are observed to be soft or unstable, should be removed and replaced with controlled fill (see recommendation #3) and inspected by a geotechnical engineer.
2. Site soils are type "C" and require bracing or slopes of 1.5:1 for excavation over 5 feet per OSHA 29 CFR Part 1926.
3. Controlled Fill:
 - a. Sand and Gravel with less than 20% passing the #200 sieve.
 - b. Recycled Concrete Aggregate (RCA) with less than 20% passing the #200 sieve.

- c. The onsite fill consisting of Fill, Organic Silt or Silty Sand is unsuitable for use as controlled fill.
- d. Any earthwork required between Nov. 1st and April 1st should be in accordance with New York DOT Standard Specification Section 304-2 –Materials –*Winter Earthwork Submittal*.

4. Compaction:

- a. All controlled fill should be placed in layers of eight to twelve (8-12) inches in loose thickness and be uniformly compacted to achieve a density of at least ninety-five (95) percent of the maximum dry density as determined by in the laboratory when tested in accordance with the most recent ASTM D1557 Standard.
- b. Backfill within confined areas should be placed in layers of six to eight (6-8) inches in loose thickness and compacted to the same 95% of maximum dry density using portable compaction equipment.

5. Paving specifications:

(From the New York State Department of Transportation Standard Specification Amended January 6, 2011,)

a. Parking Lots:

- i. Use six (6) inches of Quarry Process Stone (QP) as a sub-base.
- ii. Use four (4) inches of Bituminous Stabilized Base Course (Type 1).
- iii. Use two (2) inches of Hot Mix Asphalt Surface Course (Type 6).

b. Roadways:

- i. Use six (6) inches of Quarry Process Stone (QP) as a sub-base.
- ii. Use six (6) inches of Bituminous Stabilized Base Course (Type 1).
- iii. Use two (2) inches of Hot Mix Asphalt Surface Course. (Type 6).

6. The following construction tasks should be inspected by a geotechnical engineer using appropriate laboratory and field testing support:

- Compaction and proof rolling of soils of all subgrade levels.
- Approve all types of controlled fill soils to be used as backfill.
- Compaction of all controlled fill in parking lot and roadway areas.

The recommendations above are based on the data obtained from soil borings performed at the indicated specific locations and from other identified information. This report does not reflect any variations which may occur between borings or across the site apart from the borings. The nature and extent of such variations may not become evident until construction. If variations appear evident, it will be necessary to re-evaluate the recommendations of this report.

This report has been prepared for the specific application to the project noted. In the event that there are changes in the nature, design or locations of the proposed structures, the conclusions and recommendations contained herein are not valid unless the changes are reviewed and the recommendations modified in writing by JSC.

The information and opinions rendered in our report are exclusively for use by **RV Drilling Company** and JSC will not distribute or publish this report without written consent except as required by law or court order. The information and opinions expressed in this report are given in response to a limited assignment and should be considered and implemented only in light of that assignment. The services provided by JSC in completing this project were consistent with normal standards of the profession. No warranty, expressed or implied, is made.

The following Plates are attached to this report:

Plate 1 -	Site Location Map
Plates 2A through 2G -	Boring Location Plans
Plates 3A through 3U -	Logs of Borings
Plate 4 -	Unified Soil Classification System

Very truly yours,
JOHNSON SOILS COMPANY

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